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Two Way Communication for the Differently Abled.

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Abstract :Communication is the main channel for the people to interact with each other, every day we see many people who are facing challenges like deaf, dumb, facing the difficulty to interact with others. Due to birth defects, injuries and oral disorders, there has been a dramatic increase in the number of deaf and deaf victims in recent years. As they are unable to communicate with normal people, they must rely on some kind of visual communication. Formerly developed techniques are all sensors based and they didn't give the general solution and were not economical. One of the main paradigms that we focus on is to endeavour the linking between the Sign Language medium with the Standard English Language and thus providing the communication between the two communities in a seamless experience. This project is developed in such a way to allow two-way communication between the one who knows the sign language (deaf and dumb) and the one who doesn't(rest).Our project uses camera to take images of different gestures and image processing technique is used to recognise gestures and give audio and text as an output. On the other hand, for the reply our project will also process Speech to give back Sign language gestures as a reply to complete two-way communication.

Keywords:-Speech to Text , HSV(Hue Saturation Value) Model;CNN (convolutional neural network); Image Conversion

I. INTRODUCTION

Technology has revolutionized the mankind, improving our lifestyles day by day. There is tremendous work on various technological sectors like Machine Learning, IoT, Artificial Intelligence, Smart devices etc. This work would lead to innovate and improves one's life. But for the differently abled there has been much less analysis. This topic has got less attention as compared to other sectors.

A sign language is a language that utilizes visually articulated sign patterns (manual voice, body language, and lip patterns) instead of acoustically transmitted sound patterns. To communicate meaning — integrating hand gestures, hands, limbs, or body orientation at the same time and facial expressions to articulate a speaker's speech thoughts in a fluid manner.

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Sign languages typically develop in deaf communities that includes interpreters, friends, and families of deaf people as well as deaf or hard-to-understand individuals. Sign language develops wherever deaf-people populations exist. In-fact their unique spatial grammars vary from the grammars of the spoken languages. There are thousands of sign languages in use around the world and they are at the heart of deaf local cultures. Some sign languages got some form of legal recognition, while others have almost no standing.

A lot of methods and modulations are being implemented at present and are under study to reduce or simplify the ambiguity of sign language to voice. Human gestures are an important symbol of human communication and an attribute of informally known human actions as the body language. A great deal of techniques are being used to follow human motions. To get maximum accuracy and to bring out the system unique a lot of methods are attempted and best case is user defined actions (gestures) to control the system.

Interesting techniques are being developed for speech recognition but in the current market, there is actually no real commercial product for sign recognition. The idea is to make machines to understand human language and create user-friendly interfaces for human computers (HCI). Making a machine understand speech, facial expressions and human movements are some moves in that direction. Gestures are the non-verbally exchanged information. Innumerable amount of gestures can be performed at an instant by a person.

The motive of our work is to provide a two-way medium for the differently abled and help them communicate. Since gestures play a very important role thus the usage of gesture recognition can very be applied in various

sections of the society, as its application ranges from the scientific usage Human Computer Interactions (HCI). Sign Language is an abstract entity directed at natural language whose origin depends on the "Sign" or the "Gestures" and is the natural way for communication between the taciturn and vocally-debilitated people.

Our system will recognize the hand gestures present in the manual and give text as well as speech as output which will help the blind, deaf and dumb to communicate with each other without the aid of human mediator. And on the other hand, taking Speech as an input to give back gesture as an output completing the two-way communication.

II. LITERATURESURVEY

•Pallavi Verma, Shimi S.L, Richa Priyadarshani

They aimed for Design of communication interpreter for deaf and dumb people[9]. For the gesture recognition pair of gloves were used like flex sensors were installed along each finger.

They have used the voltage driver rule for capturing the movement of the user, the microcontroller will digitize the data and this data is decoded and the system matches the given input, if the data is matched then this is sent to the speaker which act as the output result source. But this model has some limitations like it lags and it is much costly than other models.

•V.Padmanabhan and M.Sornalathap's project Hand Gesture Recognition and Voice conversion for deaf and dumb [10]

Its aim is to reduce the communication gap among the deaf and dumb and the one who doesn'tknow sign language by using gloves with accelerometer sensors to sense the movement, and recognizes the gesture. In world applications, this system is helpful for mute community and for those who cannot communicate but with these method users will have to carry Gloves to communicate with deaf and dumb and it also uses microcontroller, sensors which increases the cost.

•Gesture recognition to voice conversion using electronic hand glove [11] by K.Hemavani mainly focuses on the providing gesture to voice by using a flex-sensor and a magnetometer to sense the movement made by fingers. A low power ARM Cortex-M4 microcontroller recognizes the movement by means of acquiring, processing and running a sensor fusion algorithm. The demerit of this system is that is uses a microcontroller which is used to speedup the process but in doing so it requires additional hardware which significantly increases the cost and Magnetometer's accuracy drops drastically after long use.

•Glove for gesture recognition using flex sensor [12]introduced by Mandar Tawde , Hariom Singh and Shoeb Shaikh presents a hardware system to convert Sign Language to auditory speech fro which they use flex sensors , Atmel ATmega168 microprocessor and Google Speech API to convert speech to readable text that basically enables them to Uses flex sensor and reads variable resistance values to track the hand movement. This system's drawback is that the sensor wears off over time and performance decreases and is costly.

III. PROPOSED SYSTEM

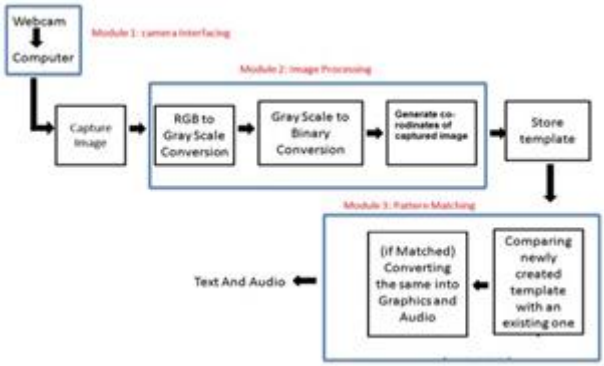

Fig. 1. System Diagram for proposed System (Gesture to Text/Audio)

$$H = across \frac{0.5 \times ((R-G) + (R-B)}{\sqrt{(R-G)^2 + (R-B) + (G-B)}}$$

$$S = 1 - 3\frac{\min(R,G,B)}{R+G+B}$$

$$V = \frac{1}{3}(R+G+B)$$

According to the above flowchart in the second module of the image processing where conversion of the image to the gray scale and then conversion of gray scale is done to binary is done instead of doing these such steps, we are implementing the HSV model. This model is much efficient than other conventional steps as HSV model overcomes all the drawbacks of the other model.

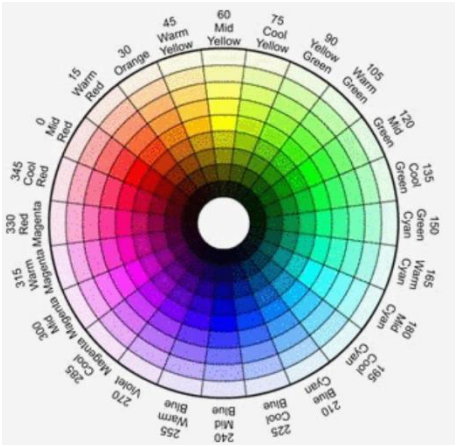

Fig.2. HSV Color Wheel

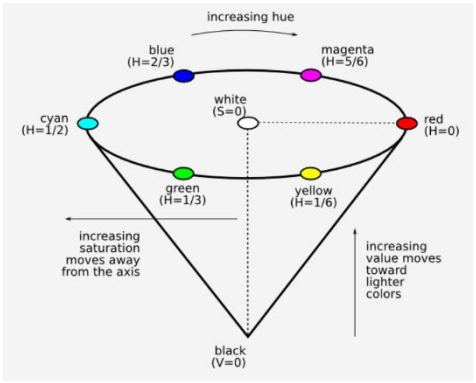

Fig.3. HSV Color Model

In The second module it includes RGB to HSV conversion - since converting the image to the HSV is much better and efficient to isolate the colours.

HSV stands for the hue, saturation, value.

According to this, it helps us to provide the perception representation model with human visual features. In this H stands for the hue means the colour we want, saturation tells us the intensity of the image and at the last, the value tells us about the lightness of the image. We can understand that the HSV like cylindrical geometry in shape which is divided into many sectors ranging from 0* to 360* which is covered by Hue, saturation ranges from the 0 to 100% and sometimes called the "purity", and the value also ranges from the 0 to 100%. The main division of this cylinder on the basis of the color is with Hue starting angle consist of the red color at 0* after this green primary color takes place at the 120* and at the 240* primary blue color takes place and now the circle completes at the 360* back to the red color.

While in some software hue ranges from 0 to 1 instead of the 0 to 360 like MATLAB.

Now in the next step, we have to apply the threshold mask for isolating the color we have to apply the multiple masks. Now a range of thresholds will be set for hue, saturation, value. Any pixel which ranges in these threshold values will be automatically set to value 1 and else will be 0.

Now the 3rd module will focus on the database management for the gathered image until now. All the coordinates which are calculated until now will be stored in the form of template. Now with the help of the machine learning it will start mapping/matching with the templates i.e. the coordinates one. If the mapping is done accurately it will generate the expected result int the form of audio and textual form. Hence this model consists of the two different modes i.e. training mode and the other is operational mode where training mode is part of machine learning in which we train our data to get the expected result much accurately i.e. alphabet recognition.

After detecting the colour of skin from above HSV colour gamut we will then resize the masked image to 64x64 now we have to predict from the trained model using "predict" function. After using the function, we get the matched model and each model represents specific text or statement. This statement is then given as an input to Google Text to Speech API commonly known as gTTS API. Python has inbuilt library which is a very easy to use tool which converts the text entered, into audio which can be saved as a mp3 file.

Google API for the speech to text conversion uses the HMM model for the prediction of the speech in the conversion to the text.

The gTTS API supports several languages including English, Hindi, Tamil, French, German and many more. The speech can be delivered in any one of the two available audio speeds, fast or slow.

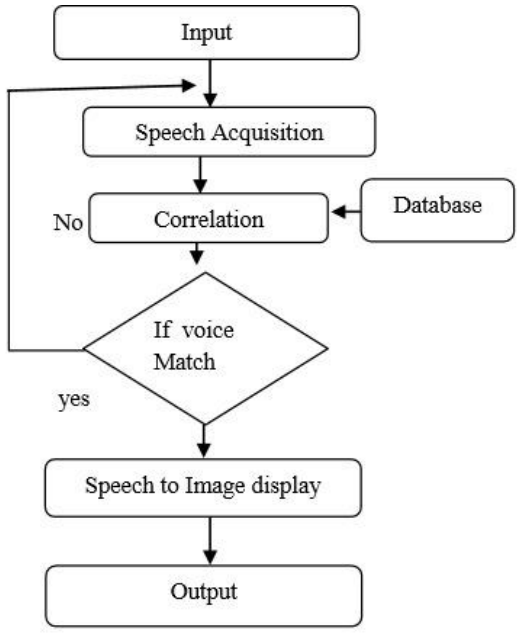

Fig. 4. System Diagram for proposed System (Text/Audio to Gesture)

This model takes voice as an input and displaying image as an output. While taking the next step towards this model we have to use the microphone of the device which can do all the necessary task for the successful input of the voice. Now our next step is how the device will understand the given voice, how it will process the data and for that we have used the **Google speech recognition**, with the help of this tool our device can now recognise the voice much precisely. As earlier we have given the data in the database and we will now again use the same data for the second objective of this model, like images of the alphabets and numbers and some important sentences are already stored in the database. Now according to the voice our engine will try to match the data with the data which is already in our database if the model will find the matching pattern with the given input then the device will show the image relevant to the input given. Hence in this way by using the voice as an input we can generate the image or the gesture for the deaf people.

IV. RESULTS

Camera Capture: -

Fig. 5. Input Image

In the above shown image we can see that hand gesture image has been captured. After that according to our approach we have to convert the captured image into binary image which consist of 1 and 0.

Fig. 6. Obtained Binary Image

The above-mentioned image is a binary image which is basically black and white. To convert the image into desired binary we set HSV value of skin and obtained the image.

Fig. 7. Recognised Text

After the conversion of the image mapping is done of the image and the text and the final text can be seen in the fig3. Hence our model successfully generates the text from the gesture. Then this text is sent to online API to get audio.

V. CONCLUSION

Two-Way Communication for the Differently Abled helps to develop a system which can recognize the Gestures made by disabled persons and gives the audio and text as an output, thus helping them to communicate with others (not knowing the sign language) easily using the Gesture Recognition, On the other hand it also makes it possible to receive an audio or speech as an input to generate text and gesture as an output.

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